A TRAP FOR COLLISION STUDIES AT VERY LOW TEMPERTURE (<10 K)

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Recent measurements[1,2,3,4] of charge exchange cross sections for collisions of highly charged ions (HCIs) with H_2 molecules have shown the feasibility of the study of ion-atom collisions at very low center-of-mass energies (~ 6 eV). These measurements were carried out in a cryogenic Penning trap, (RETRAP[5]) at the Lawrence Livermore National Laboratorys (LLNL) EBIT[6] (Electron Beam Ion Trap) facility

In order to study such collisions at even lower energies cooling schemes have to be applied. One possible scenario is the sympathetic cooling of the HCIs with singly charged Be. The Be can be laser cooled to temperatures of less then 1 K. HCIs are then merged with the cold Beryllium cloud. Provided that both species couple collisionally, the mixture will eventually reach a thermal equilibrium. If the charge over mass ratios of the different species is very different, separation of the species can be expected.

To implement this cooling scheme at RETRAP the open ended cylindrical trap was replaced by an assembly of four Penning traps (see fig.1). In this context only the two inner traps with hyperbolic electrodes have to be considered. Both are equipped with circuits for axial detection and excitation of the ions. In addition the bottom hyperbolical trap has ports for laser-access and detection of flourescent light.

The performance, the trapping efficiencies and cooling times in these traps will be discussed. First images of the lasercooled Be-cloud show an increasing separation of Be^{2+} and Be^{+} with decreasing temperature.

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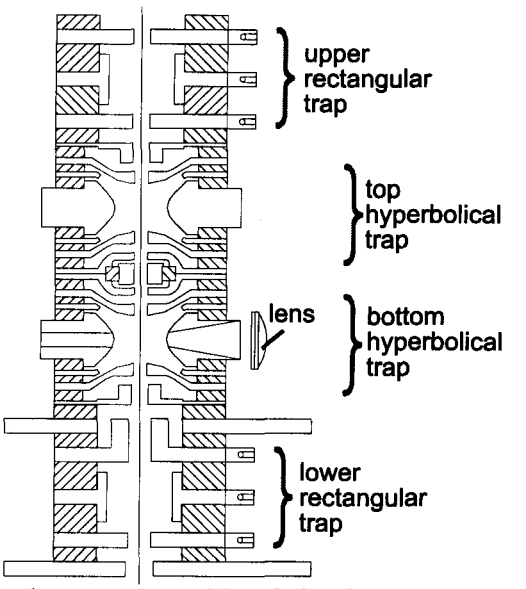

Figure 1. Assembly of the four Penning traps currently in RETRAP. The bottom hyperbolical trap has a lens mounted close to the trap center to increase the solid angel for the flourescence light detection.

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